NDIA 45th Annual Fuze Conference

Ordnance Fuzing/Safety & Arming Programs Overview

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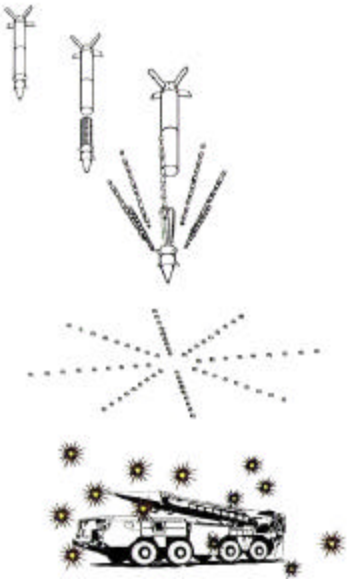
NAVSEA
INDIAN HEAD
Surface Warfare Center Division

OUTLINE

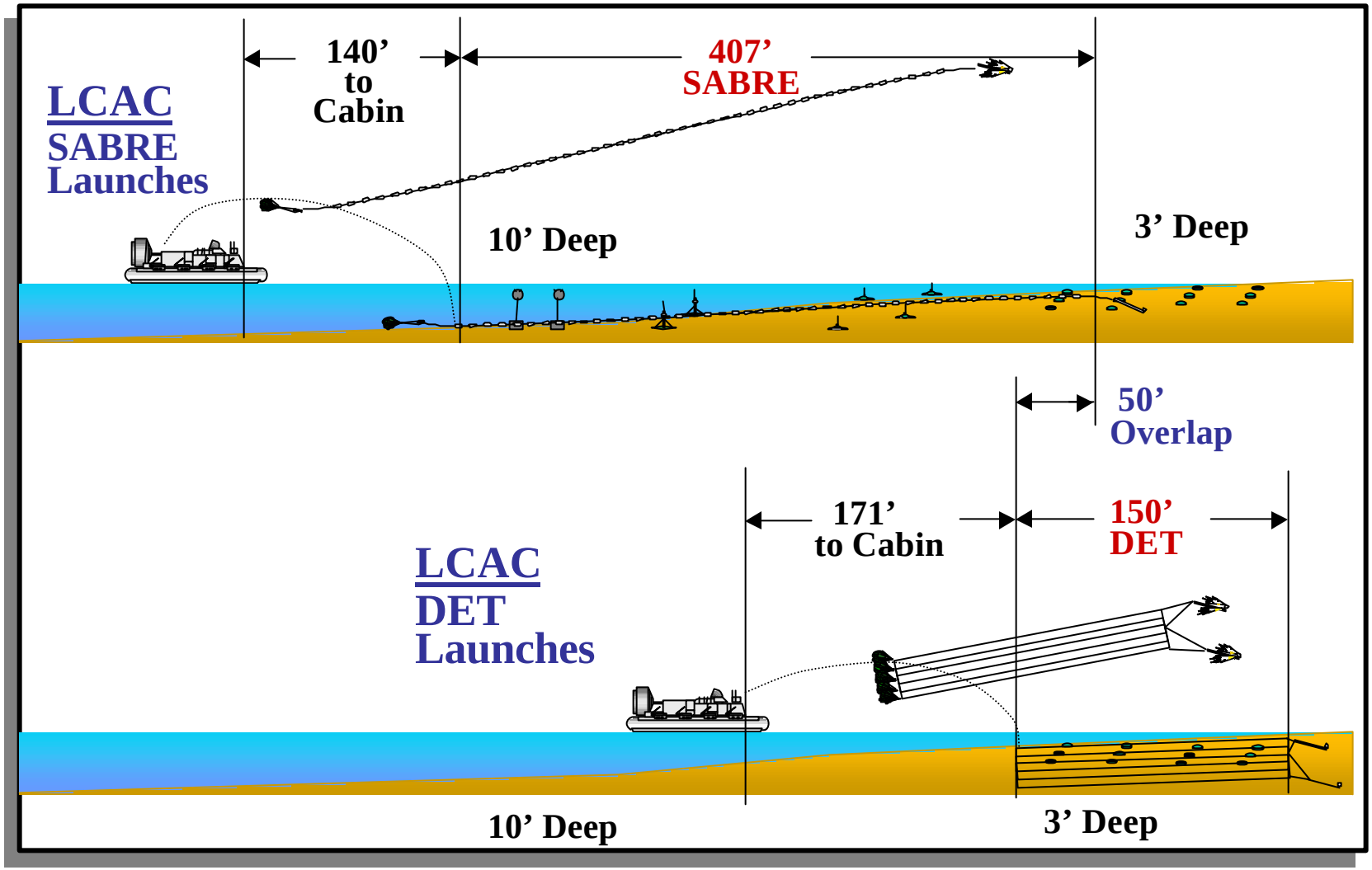
- **Current Development Programs**
- **Product Improvement Programs**
- **Applied MEMS Technology Programs**




Current Development Programs

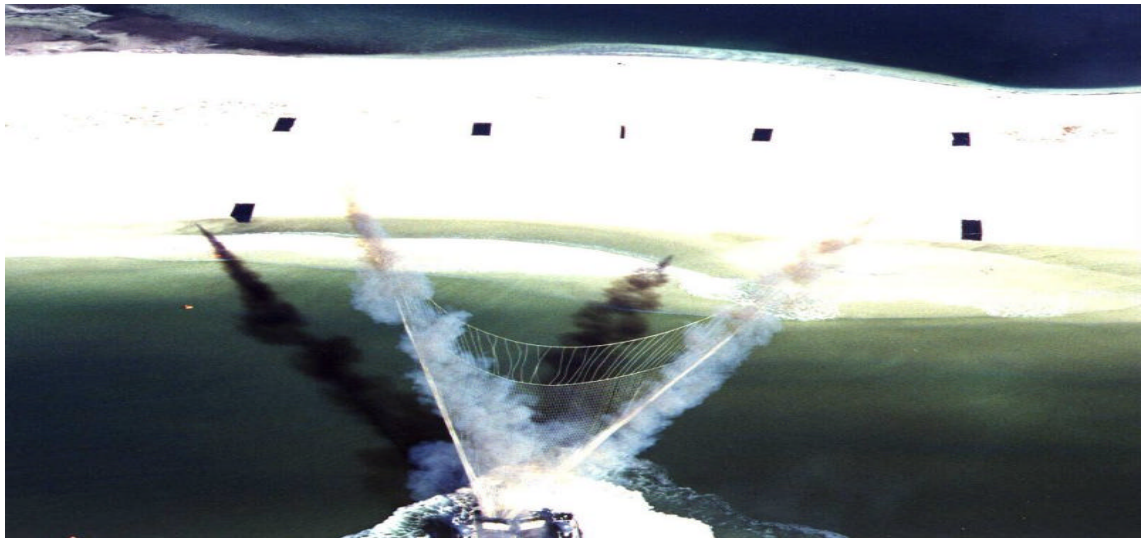
Navy Assault Breaching Systems

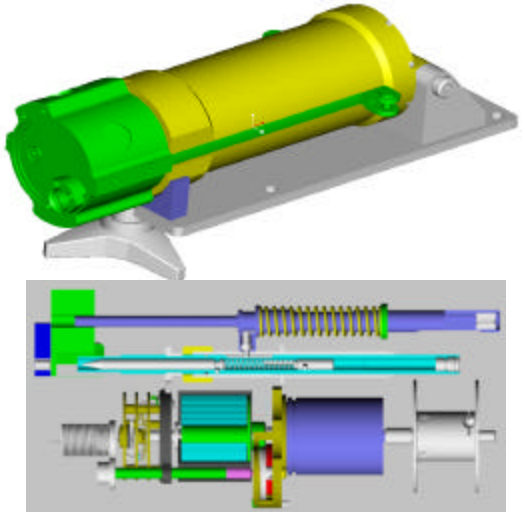


DET SURF ZONE MINE CLEARANCE SYSTEM TEST

DET Fuze/S&A

- **Distributed Explosive Technology (DET)**
  - **180'x180' Explosive Net Used in Surf Zone Mine Clearance**
- **All Mechanical Fuze/Safety and Arming Device**
- **DET Technical Evaluation Completed**
- **DET Operational Evaluation Currently on Hold**
  - **May be Combined with SABRE OPEVAL Scheduled FY03**





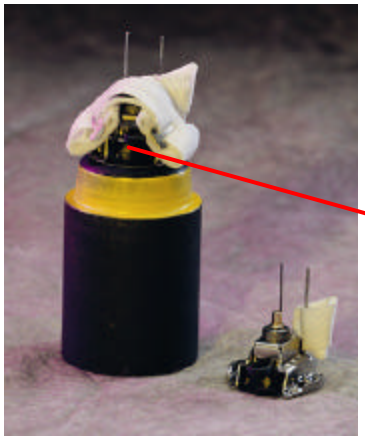
SABRE Fuze/S&A

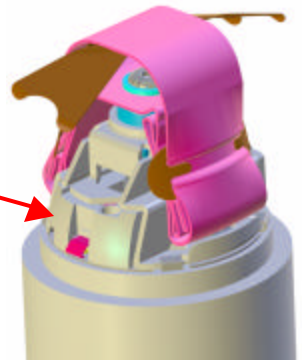
NEW START *-- New Fuze/S&A for Shallow-water Assault Breaching (SABRE) System*

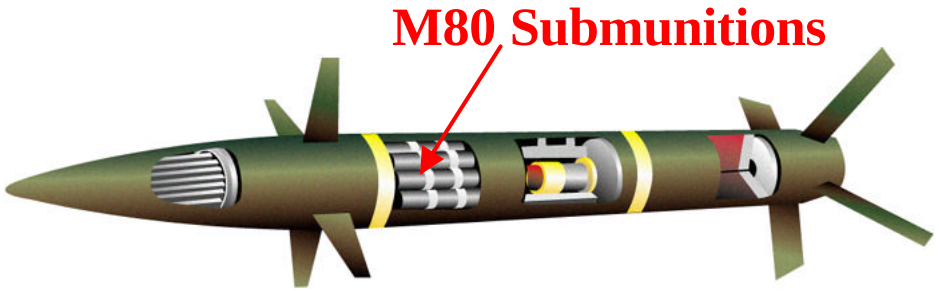
- **Contractor Development - Contract Award in Process**
- **Fire-and-Forget Fuze/Safety and Arming System**
- **Requires Extremely High Reliability**
- **Support SABRE System MS III Production Decision of March 2003**

P3I Programs

- **NSFS ERGM EX171 M80 Submunition PIP Proximity Fuze Insertion**







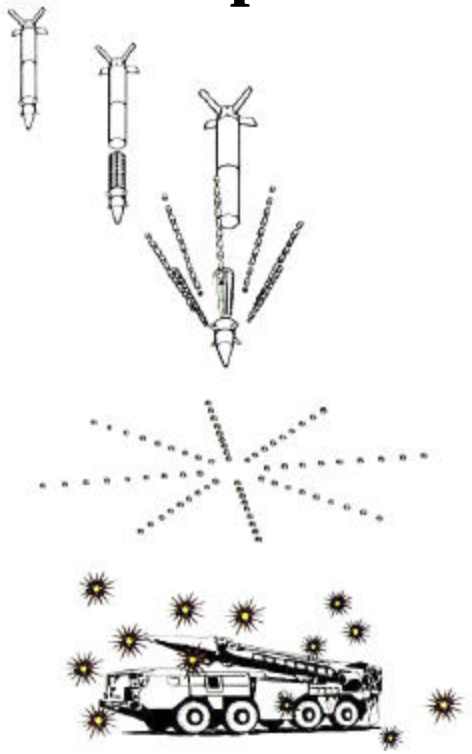
- **Next Generation Small Active Electromagnetic Torpedo Fuze**

EM Fuzed Torpedo Shell Section

NSFS ERGM M80 Product Improvement Program (PIP)

PROGRAM GOALS:

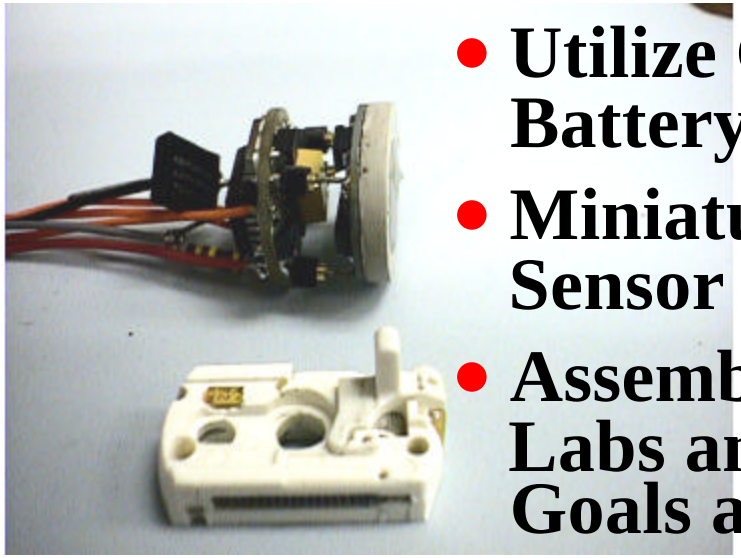
- **Develop an Add-on Proximity Fuze System**
  - **Inserted within the M234 SD Fuze Envelope**
  - **Minimal Impact to M234 SD Fuze High Rate Production Equipment**
  - **Meet ERGM Safety, Performance, Environmental, & Life Cycle Requirements**



NSFS ERGM M80 PIP
Proximity Fuze System Insertion

TECHNICAL APPROACH:

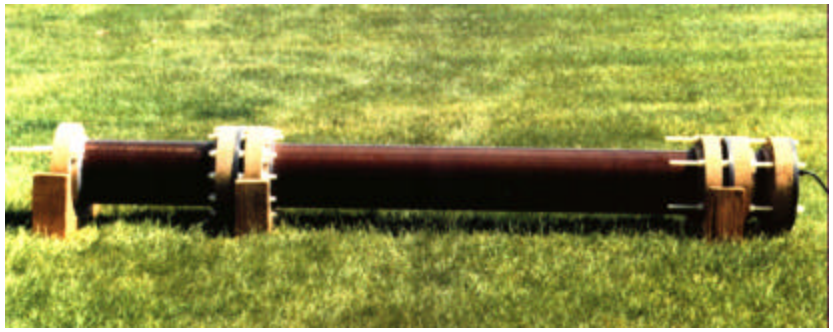
- **One-for-One Replacement of the M234 Self-Destruct (SD) Fuze Slide Assembly**

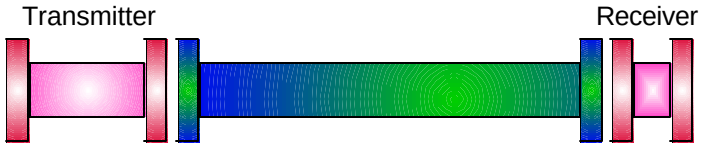


- **Utilize Gun Launch Environment for Battery Activation**
- **Miniaturize the FM/CW RF Proximity Sensor of the M734A1 Mortar Fuze**
- **Assemble Expertise from Army / Navy Labs and Industry to Achieve Technical Goals and Reduce Critical Risk Areas**

EAGLE PICHER TECHNOLOGIES, LLC

Reduced Power Active EM Fuze Underwater Torpedo Applications



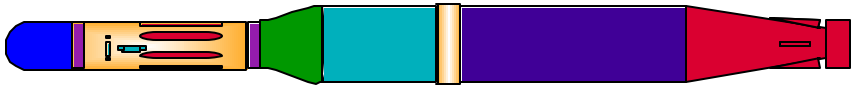


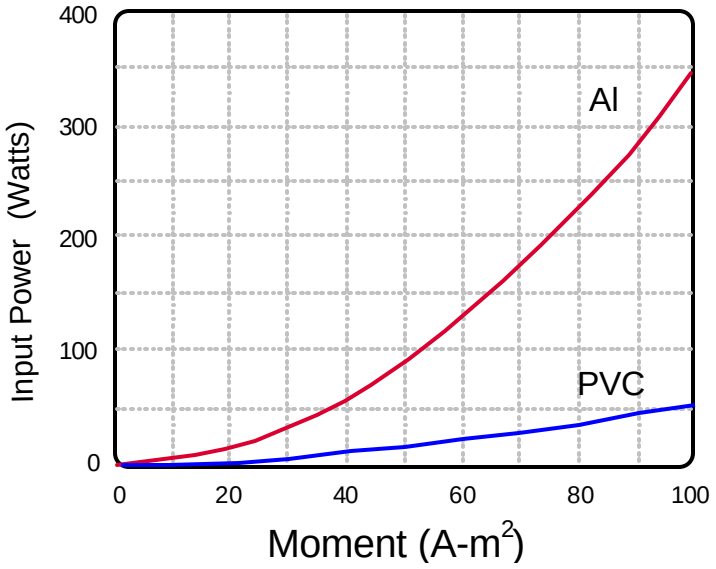
Proof-of-Principle Demonstrated

- **7:1** Reduction Input Power
- Multiple Transmitter Designs
- Suitability of EM Fuzing for Small Diameter torpedoes

Successful Torpedo Sea Run Tests

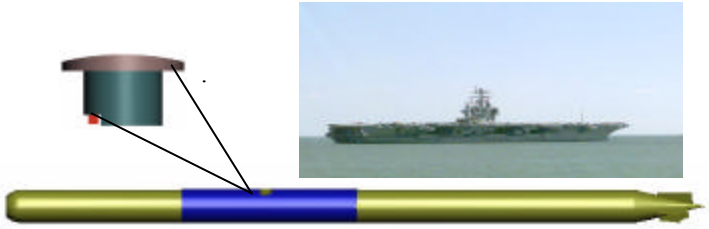
- Dynamic Environments
- Target Detection
- Model Validation

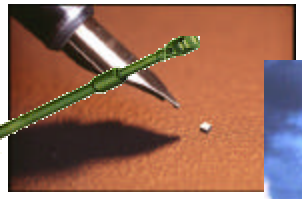




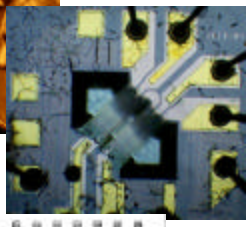
Applied MEMS Technology

- Surface Ship ATT F/S&A Device
- Standard Missile Embedded Sensors
- Ordnance Inventory & Surveillance





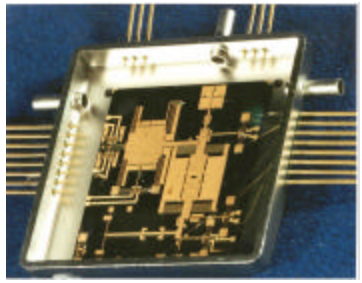

NAVY MEMS-BASED F/S&A PROGRAM

OBJECTIVE:

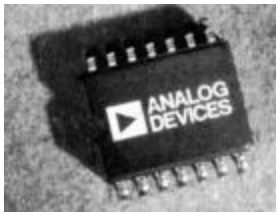
- Apply & Transition MEMS Technology to Undersea Weapon F/S&A Systems

APPROACH:

- Capitalize on the MEMS Industrial Base
  - Commercial (COTS) Sensors & Devices
- Leverage DARPA Funded Infrastructure
  - Design, Modeling & Analyses Capability
- Demonstrate MEMS F/S&A Reliability
  - Assure Weapon Safety with Miniaturized Modular Architecture



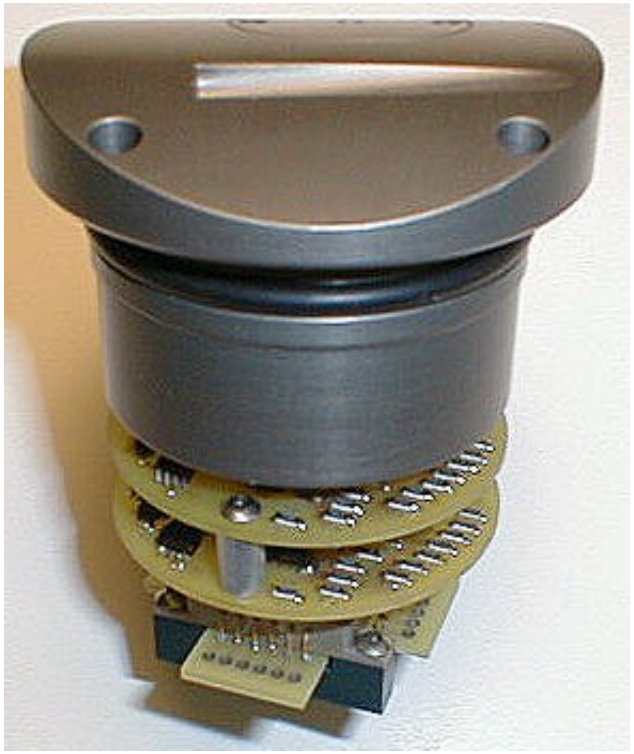
MEMS F/S&A TECHNOLOGY
COTS / Modular Components



Impact Sensor

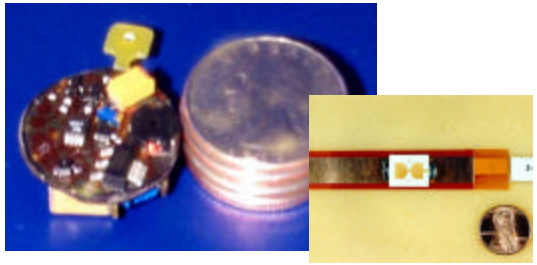
Flow Sensor:
Pressure Differential

Inertial Measurement
Rate Sensor

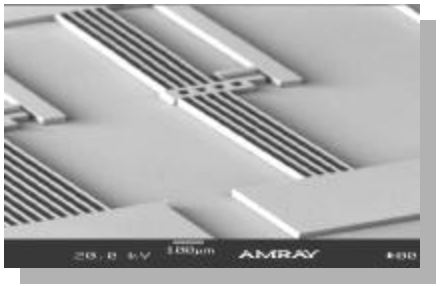


Typical Building Block Components for MEMS-Based Exploder

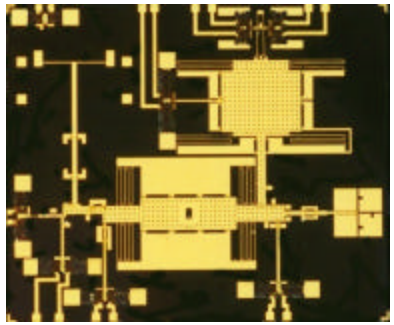
DARPA
MTO MEMS



Initiation System
Slapper, Fire-set & Optical
Charging Circuit



DRIE MEMS CHIP



LIGA S&A Chip

TORPEDO MEMS F/S&A

NAVSEA INDIAN HEAD Surface Warfare Center Division

OFFICE OF NAVAL RESEARCH

DARPA MTO MEMS

Main Objective: Transition MEMS F/S&A Technology for FY 02 CCAT E&MD Start

Technology Focus:

- MEMS Fabrication
- Packaging Reliability and Robustness
- Inertial Sensor (IMU) Technology
- Remote Initiation Systems
- Optical Interruption

Prototype Development:

- Develop/Build 15 S&A Prototypes
- Conduct Environmental and Field T&E
- Utilize IHD MEMS Clean Room for MEMS S&A Prototypes Packaging, Assembly, & Test

UNDERSEA DEFENSIVE WARFARE PMS 415

Standard Missile

- Installing Temperature Data Loggers to Canisters
- Funded to Develop Embedded Stress Gauges
- Funded to Develop Embedded Ultrasonic Sensors

Advanced Technology Ordnance Surveillance (ATOS)

- Selected by OSD as an FY 01 Advanced Concept Technology Demonstration
- Demonstrate operational utility of miniature radio frequency identification (RFID) tags coupled with micro-electromechanical sensor (MEMs) technology for use in tracking/monitoring critical items:
  - Joint “high dollar/low density” munitions
  - Category I munitions (high potential of theft/terrorist use)
  - Future Potential: Medical and biological supplies, perishable substance and other environmentally sensitive commodities, DU munitions, etc.

MEMS Sensors

- Temperature
- Humidity
- Stress/Strain
- Acceleration
  - Shock/Vibration History
- Chemistry Lab on a Chip
  - Presence of Degradation Products
  - Stabilizer Depletion

NAVSEA
INDIAN HEAD
Surface Warfare Center Division

FUZE / SAFE & ARMING FOR THE 21ST Century

- **Challenges / Opportunities**
  - Shrinking DOD budgets / downsizing
  - Affordable weapon systems / reduced LCC
  - Smarter, multipurpose weapon systems
  - Acquisition reform
  - Maintain critical smart F/S&A core within DOD
  - Miniaturization

- **Approach**
  - Focus on electronics & emerging MEMS technology in industry
  - Increase joint service collaborative efforts
  - Develop “building Block” approach for universal application